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School-Level Poverty Measures Using BlindSIDE

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For more information on the IES SLDS Grant Program or for support with system development, please visit *http://nces.ed.gov/programs/SLDS*.

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Poverty plays a role in many challenges and outcomes for children, including their school experiences, academic performance, and future opportunities. Education agencies need to understand how poverty affects students and their school communities in order to support student achievement, address equity gaps, and allocate funds effectively. However, data commonly used to measure student poverty—such as eligibility for free and reduced-price lunch (FRPL) programs—have significant limitations.

The National Center for Education Statistics (NCES) is exploring a new approach to estimating student poverty that may give education agencies and researchers more accurate information about student economic disadvantage. NCES's Spatially Interpolated Demographic Estimates (SIDE) Project and the companion application BlindSIDE use data from the U.S. Census Bureau's American Community Survey (ACS) to estimate household income in student neighborhoods in more detail than possible with existing poverty indicators.

Fifteen states received federal funding to test the BlindSIDE application and evaluate the usefulness of its poverty estimates. These states have different levels of experience with and capacity for collecting the student address data needed to estimate neighborhood poverty with BlindSIDE. Representatives from Kansas, North Dakota, and Wisconsin share preliminary results from pilot testing BlindSIDE and how its estimates could potentially supplement existing measures of school-level poverty.

Exploring Alternative School-Level Poverty Measures

For decades, education agencies have used students' FRPL eligibility as a proxy measure for household income. The U.S. Department of Agriculture's National School Lunch Program offers free meals at school for students whose household income is at or below 130 percent of the federal poverty level. Students with a household income between 130 and 185 percent of the poverty level are eligible for reduced-price meals.

Despite being widely used over many years, FRPL eligibility data often pose significant limitations for researchers and program administrators because the data were originally designed to help operate school nutrition programs rather than to study student

academic outcomes. Common limitations of FRPL data include the following:

- Few students have their household incomes verified to confirm eligibility.
- Schools in very low-income communities may report all of their students as FRPL eligible under the National School Lunch Program's Community Eligibility Provision, regardless of their actual household incomes. In addition to increasing the number of students counted as low income, this provision makes it difficult to accurately compare counts of eligible students before and after it was implemented.
- FRPL eligibility is a binary indicator. Students are identified as either meeting the income threshold or not, without more detailed information about their household income levels.

SIDE: A new approach to estimating household income

NCES's SIDE Project uses new, experimental statistical models to estimate household income based on the neighborhood conditions where students live. Given the latitude and longitude coordinates of a student's home address, SIDE pulls income data from the 25 nearest households with children included in the ACS. It then weights those income data based on proximity to the address in question to predict household income at that location. SIDE estimates are expressed as income-to-poverty ratio (IPR) values, which indicate relative income levels on a continuous scale from 0 to 999. Once fully reviewed and validated, a SIDE-estimated IPR of 100 would correspond to the federal poverty level.

The SIDE estimation process has two primary stages. The first stage builds statistical models of the relationship between physical distances between ACS cases and the differences in their reported household income, identified as IPR values. The combined collection of local models provides a poverty prediction "surface."

The second stage identifies a set of ACS cases that are nearest to the location that needs an IPR prediction and creates a prediction by combining their reported IPR values, their distances from the unmeasured location, and the known behavior of local spatial relationships identified in the first stage. This second step is applied to the center points of squares in a 300-meter grid to produce IPR estimates for all parts of the country. The result is similar to a weather map, except that the model predicts household income in the form of an IPR rather than rainfall (**FIGURE 1** on page 3).

The SIDE IPR estimates offer a number of potential advantages for income-related education research. IPR estimates predict income across a wider spectrum and with more specificity than FRPL data, which report students based on just two income thresholds. Because SIDE estimates are based on ACS responses that are nearest to an address, they offer more geographically precise income estimates than those based on larger geographic areas like counties or census tracts, which may contain a wider range of income levels. On average, SIDE's 25-neighbor clusters cover areas about one-fifth the size of a census tract. Additionally, SIDE's neighborhood-based IPR estimates pose less of a disclosure risk than program-based FRPL designations and are easier to share with researchers outside of an education agency.

What Is IPR?

An income-to-poverty ratio (IPR) expresses household income as a percentage of the federal poverty level, which varies based on household size. In 2020, the U.S. Census's poverty threshold for a family of two adults and two children was $26,246.

IPR values range from 0 to 999. FRPL eligibility thresholds of 130 percent of the poverty level for free lunch and 185 percent of the poverty level for reduced lunch correspond to IPR values of 130 and 185, respectively.

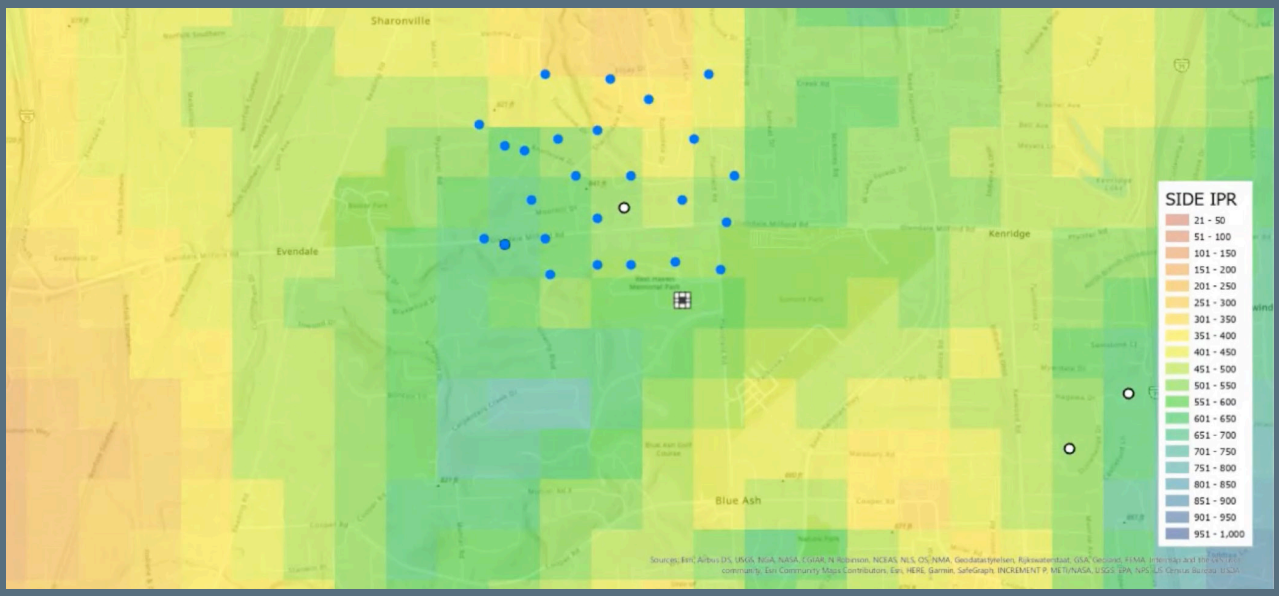
Threshold	IPR
Federal poverty level	100
Free lunch eligibility	130
Reduced-price lunch eligibility	185

Assigning student poverty estimates with BlindSIDE

The NCES Education Demographic and Geographic Estimates (EDGE) Program developed the BlindSIDE application to allow users like state education agencies to assign SIDE IPR estimates without having to share sensitive student data with NCES. The browser-based application also can summarize student IPR estimates to produce school-level poverty indicators.

Through a password-protected account, state agencies load a comma separated values (CSV) file of geocoded data to the BlindSIDE application. The file must contain unique identifiers for students and schools, as well as latitude and longitude coordinates for student addresses. The unique identifiers in the file do not need to be the same identifiers that the agency uses in its own data collections to identify students. The uploaded file also can include additional variables the agency plans to analyze once it receives IPR estimates.

FIGURE 1. NCES's SIDE program estimates IPR at a specified geographic location (white dot) based on the incomes reported at the 25 nearest households included in the ACS (simulated as blue dots). SIDE creates a prediction "surface" of continuous IPR estimates across a geographic area, similar to rainfall predictions on a weather map.



After the agency selects its address data file, BlindSIDE checks the physical extent of the address coordinates contained in the file and pulls the portions of the poverty "surface" needed for the required area. It then assigns IPR estimates to each set of address coordinates and generates two new CSV data files. A student-level data file contains the IPR estimates for each set of address coordinates appended to the agency's original data file. BlindSIDE also provides a school-level data file that contains descriptive statistics summarizing the IPR estimates.

Because BlindSIDE does not store or transmit to NCES the data files that agencies use, student data are not exposed to unauthorized access. BlindSIDE can process datasets with large numbers of records, as well as spanning large geographic areas.

To use BlindSIDE, agencies must provide geocoded latitude and longitude coordinates for student addresses. Not all state education agencies (SEAs) collect student addresses, and those that do may not geocode those addresses. The 16 state education agencies pilot testing BlindSIDE have a range of experiences collecting geocoded student address data. The following state examples describe the experiences with BlindSIDE of three SEAs with existing, limited, and no prior collections of geocoded student address data.

Kansas: Using Existing Geocoded Student Address Data in BlindSIDE

The Kansas State Department of Education (KSDE) has a statewide data collection system that includes addresses for all students enrolled in Kansas public schools. It collects the address data annually to calculate each public school district's reimbursement of costs for students who were transported at least 2.5 miles at district expense. Through a partnership with the University of Kansas, KSDE geocodes its address data using a Google Maps application programming interface (API) and state emergency services records. KSDE has latitude and longitude coordinates for more than 95 percent of student addresses.

KSDE used BlindSIDE to attach IPR estimates to 467,000 student records. It then loaded the IPR estimates into its SLDS to connect them to other student data. In general, the SIDE estimates predicted fewer Kansas students at the IPR thresholds for FRPL eligibility than were actually enrolled in FRPL programs (**TABLE 1** on page 4). The discrepancy varied with the size of the school district and in urban or rural settings.

KSDE has begun mapping the IPR estimates received from SIDE to get a detailed picture of income levels across the state (**FIGURE 2** on page 4). Analysts also

TABLE 1. KSDE found that IPR estimates from SIDE do not correspond directly to actual FRPL program enrollment, with fewer students meeting IPR thresholds for FRPL eligibility than actually receive free or reduced-price meals.

All students

IPR Estimate	Number of Students	FRPL Eligibility	Number of Students
130 or less	12,012	Free lunch	175,578
131 to 185	61,703	Reduced-price lunch	44,249
Total 185 or less	**73,715**	**Total FRPL eligible**	**219,827**

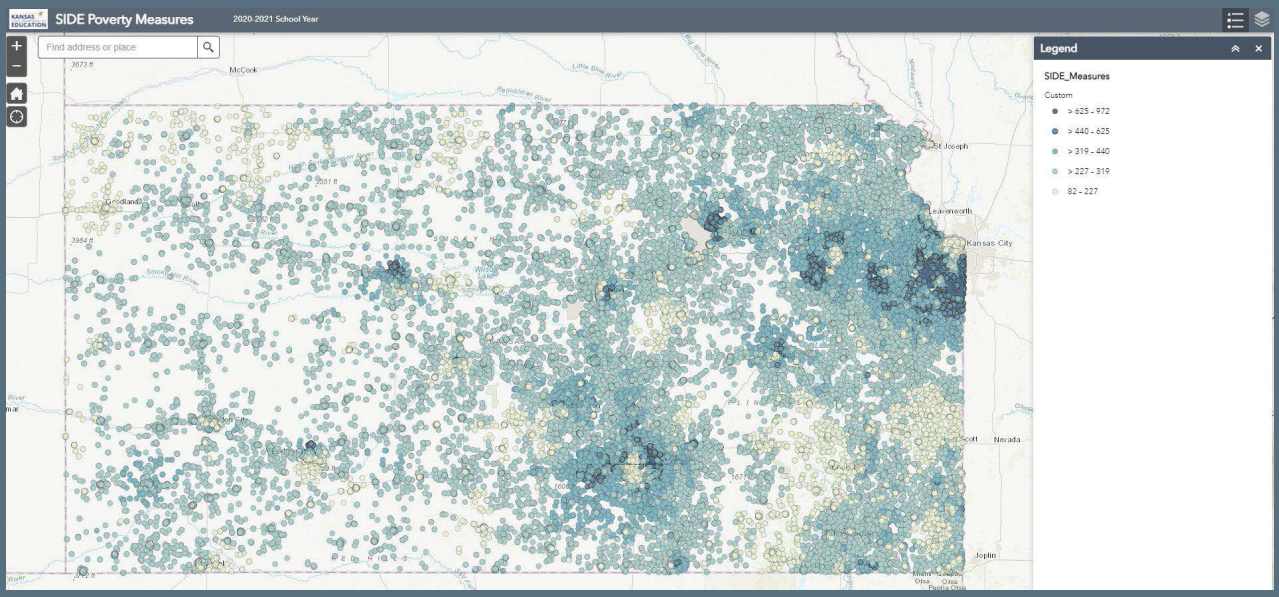
Rural district, enrollment 142

IPR Estimate	Number of Students	FRPL Eligibility	Number of Students
130 or less	0	Free lunch	60
131 to 185	0	Reduced-price lunch	24
Total 185 or less	**0**	**Total FRPL eligible**	**84**

Large district, enrollment 46,987

IPR Estimate	Number of Students	FRPL Eligibility	Number of Students
130 or less	5,952	Free lunch	31,714
131 to 185	19,317	Reduced-price lunch	4,535
Total 185 or less	**25,269**	**Total FRPL eligible**	**36,249**

FIGURE 2. KSDE has begun mapping IPR estimates for its student households to understand the geographic distribution of student poverty.



have observed a correlation between IPR estimates and rates of chronic absenteeism, and they plan to explore relationships with additional student outcomes, such as assessment scores.

North Dakota: Adding Geocodes to Existing Student Address Data for BlindSIDE

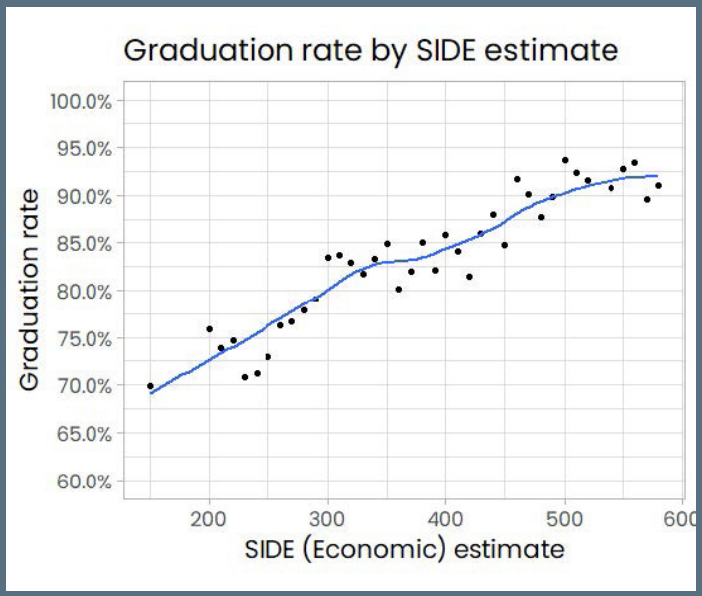
North Dakota's statewide student information system (SIS) contains student address data, but only about 7 percent of those addresses were previously geocoded. Districts can store latitude and longitude coordinates for student addresses in the system as an optional feature, and few choose to do so. Because school officials enter student addresses in an unvalidated text field, the data frequently contain misspellings and address information that cannot be geocoded, such as apartment numbers.

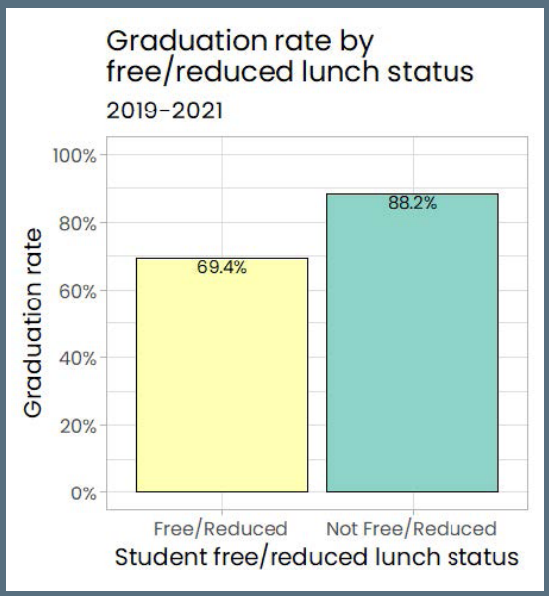
The North Dakota Information Technology Department (ITD), which manages the state's SLDS, cleaned much of the student address data to correct errors and format the data consistently before pilot testing BlindSIDE. About 81 percent of the cleaned addresses could be geocoded through the state Department of Emergency Services' enhanced 911 database.

The IPR estimates that ITD received through BlindSIDE tended to be higher than expected given the number of FRPL-enrolled students in the state. Large, urban districts had smaller discrepancies between actual numbers of FRPL-eligible students and students predicted to be eligible based on IPR estimates.

ITD has conducted preliminary analyses to explore the relationships between SIDE-generated IPR estimates of household income and student outcomes. The IPR estimates allow analysts to examine relationships in more detail and granularity than current FRPL eligibility data can offer. Connecting exiting FRPL data to high school graduation rates shows that FRPL-eligible students are less likely to graduate than noneligible students, but IPR estimates illustrate how graduation rate changes over more levels of income (**FIGURE 3**). ITD is working with SIS administrators and geographic information system (GIS) coordinators in the state to determine how to continue collecting, geocoding, and using student address data in the future.

FIGURE 3. By connecting IPR estimates from SIDE to other student data, ITD can examine relationships between students' household income and outcomes such as graduation rate (left) in greater detail than using only FRPL eligibility as a proxy for household income (right).





NOTE: Data points in the left-hand chart represent groups of at least 100 students with similar IPR estimates (rounded to the nearest 10) who had address data in North Dakota's SLDS for the 2019-2021 time period. Points are plotted by IPR estimate from SIDE on the x axis and graduation rate for the group on the y axis. Each group may contain both FRPL and non-FRPL students. The blue line models the relationship between IPR estimate and graduation rate.

Wisconsin: Testing BlindSIDE With Newly Collected Student Addresses

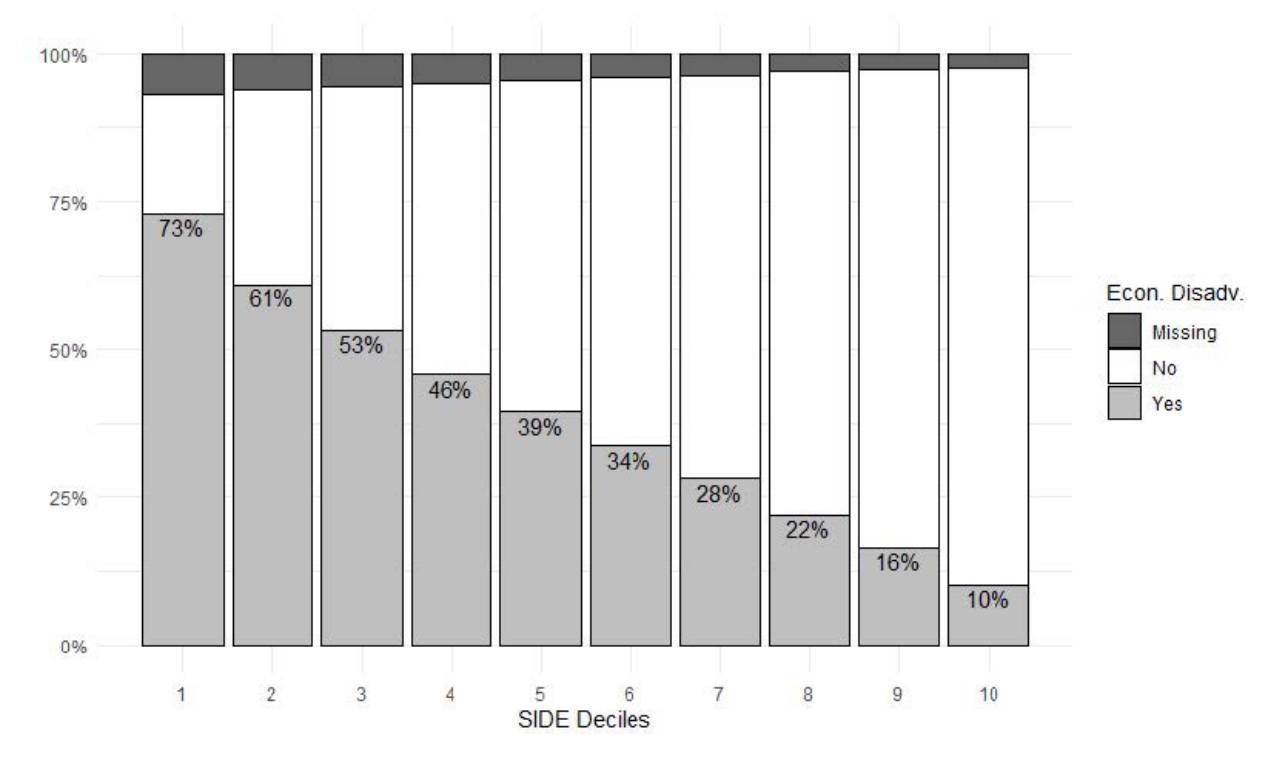
Prior to participating in the BlindSIDE pilot, Wisconsin's Department of Public Instruction (DPI) did not collect student addresses from all districts in its SLDS. In addition to alternative school-level poverty measures, the department was interested in questions about early childhood programs, early warning indicators, postsecondary readiness, and digital equity gaps that also would benefit from having student address data. It invited districts to submit student addresses to the SLDS voluntarily to test BlindSIDE and lay the groundwork for future analysis.

More than half of Wisconsin's public school districts shared student addresses with DPI. DPI cleaned the data and attached latitude and longitude coordinates through the State Legislative Services. Because not all districts shared data, the geocoded address data disproportionately represent smaller school districts and White students.

As in Kansas and North Dakota, DPI analysts noticed a significant discrepancy between the number of students with low IPR estimates and the number of students considered economically disadvantaged by other measures. In Wisconsin, districts can use measures other than FRPL eligibility to identify students as economically disadvantaged. Less than 7 percent of students in the dataset submitted to BlindSIDE had IPR estimates under the FRPL threshold of 185, while 38 percent of students were FRPL eligible or met other state measures of economic disadvantage. The number of students considered economically disadvantaged did decline as IPR estimates increased (**FIGURE 4**).

DPI anticipates a number of benefits to including IPR estimates in future data collection and analysis. Districts that do not report FRPL eligibility as a measure of economic disadvantage could use IPR estimates in place of other measures, which vary across districts and can be difficult to compare. IPR estimates are easier to share with researchers than FRPL eligibility data. In addition to allowing for more detailed analyses of trends based on household income, IPR estimates also can be used to create aggregated poverty and income inequality measures for schools and districts. DPI identified a few questions to resolve when collecting, geocoding,

FIGURE 4. Wisconsin DPI observed a correlation between IPR estimates from SIDE and its other measures of economic disadvantage. As IPR estimates increased, the number of students considered economically disadvantaged by other measures declined.



and using student address data and IPR values going forward, including how to handle students with more than one reported address and how to use and display IPR estimates in data reports and dashboards.

Conclusion

Preliminary results suggest that the SIDE IPR estimates may offer an information-rich supplement to FRPL eligibility data for analyzing the effects of students' household income on academic outcomes. Because the BlindSIDE application requires latitude and longitude coordinates to return IPR estimates for student addresses, many states may need to alter or create new processes for collecting, cleaning, and geocoding address data if they wish to use BlindSIDE.

States that have created SIDE IPR estimates for their students already have begun using them to better understand the prevalence, location, and effects of student poverty. The SIDE IPR estimates are not intended to replace FRPL eligibility data for federal reporting or program administration. However, they may be a useful supplement or future alternative metric for policymaking and research related to student poverty.

Additional Resources

Kansas State Department of Education
https://www.ksde.org /

National Center for Education Statistics: School Neighborhood Poverty
https://nces.ed.gov/programs/edge/Economic/NeighborhoodPoverty

North Dakota Information Technology Department
https://www.nd.gov/itd/

SLDS Webinar: School-Level Poverty Measures: An Exploratory Pilot Project
https://slds.ed.gov/#communities/pdc/documents/20740

Wisconsin Department of Public Instruction
https://dpi.wi.gov/